K–12 AND PUBLIC OUTREACH FOR NASA FLIGHT PROJECTS: FIVE YEARS (1992–1997) OF THE ARIZONA MARS K–12 EDUCATION PROGRAM. K. S. Edgett[1], P. R. Christensen[1], P. A. Dieck[1], A. R. Kingsbury[1], S. D. Kuhlman[1], J. L. Roberts[1], D. A. Wakefield[2], J. W. Rice, Jr.[3], and J. Dodds[4], [1]Arizona Mars K–12 Education Program, Department of Geology, Arizona State University, Box 871404, Tempe, AZ 85287-1404, U.S.A. (edgett@esther.la.asu.edu), [2]Rover Elementary School, 1300 E. Watson Dr., Tempe, AZ 85283-3143, U.S.A., [3]Department of Geography, Arizona State University, Box 870104, Tempe, AZ 85287-0104, U.S.A., [4]O'Leary Junior High School, 2350 Elizabeth Rd., Twin Falls, ID 83301, U.S.A.

INTRODUCTION AND SUMMARY: The Arizona Mars K-12 Education Program began in 1992 as a means of sharing the unfolding *Mars Observer* Thermal Emission Spectrometer (TES) project with K–12 educators, students, and their families in the greater Phoenix, Arizona, area [1]. Five years later, the Arizona Mars K-12 project remains centered on what is now the unfolding *Mars Global Surveyor* (MGS) TES experiment, but the outreach effort has expanded to share other Mars missions, including *Mars Pathfinder* (MPF) [2, 3]. Audiences of the Arizona Mars K–12 effort are scattered across Arizona, North America, and around the world. Major projects in the past two years included the outreach aspects of the *Mars Pathfinder* Field Trips and Workshop in the Channeled Scabland [4, 5]; K–12 teacher workshops in Arizona, California, Idaho, and Washington; and introduction of the teacher- and kid-friendly, quarterly resource, *Red Planet Connection*. Educator response to the very personalized approach to K–12 outreach conducted by the Arizona Mars K–12 program has been quite favorable over the entire 5-year period, as evidenced by awards and endorsements conferred by the Arizona Science Teachers Association (ASTA), a speaking engagement for the National Science Teachers Association (NSTA) in April 1997, and letters and articles written by educators about the program's efforts [*e.g.,* 6].

BACKGROUND: The Arizona Mars K–12 Education Program is designed to provide opportunities for K–12 teachers and students to enhance their existing curriculum or educational experience through exposure to a real-life, interdisciplinary science investigation (the MGS TES project). The main focus has been on teachers, students, and families in Arizona, but the program has also expanded to include interested educators and students in other states and around the world. The main activities of the program include: K–12 student visits to the MGS TES facility at Arizona State University (ASU); a continuing, biannual K–12 educator workshop series; smaller, special K–12 teacher workshops; visits to K–12 classrooms and community centers/clubs; a quarterly newsletter with an adult-reading level audience, *TES News*; annual, updated K–12 educator guides about the Mars missions and education resources; and a new quarterly, age-appropriate science resource for K–8 children, *Red Planet Connection*. Additional K–12 products include occasional Spanish-language materials, lithographs, and educator resources on a WWW site (**http://esther.la.asu.edu/asu_tes/**).

The Arizona Mars K–12 Education Program began in 1992, several months before the *Mars Observer* launch. At that time, there were very few efforts underway to use the *Mars Observer* mission as a means of enhancing K–12 education. Now, five years later, all NASA Mars missions (and other planetary projects) have a built-in education and public outreach component, but in 1992, the Arizona Mars K–12 Program was a pioneering effort. The program continues to pioneer by looking for ways to reach the K–12 audience and share the Mars exploration effort in a manner that is complimentary to other Mars education projects that are underway.

Additional background on the origin, approach, and efforts of the Arizona Mars K–12 Program in 1992–1994 was published in the *Journal of Geoscience Education* and in the Astronomical Society of the Pacific's *Mercury* [3, 7].

EXAMPLE WORKSHOPS IN 1996: One of the best ways to engage K–12 educators in the science and the interdisciplinary connections involved in planetary exploration is through teacher workshops [8]. The Arizona Mars K–12 teacher workshops focus on exposing teachers to the people involved in the MGS mission, the latest information about Mars and planetary science, and the sharing of innovative classroom activities and experiences. We have conducted an on-going biannual series of teacher workshops at ASU since 1993 (our ninth in the series was scheduled for March 1, 1997, and would include opportunities for teachers and families from the Phoenix area to observe Mars through telescopes). The biannual series is designed to always attract new educators but at the same time give others a reason to keep coming back. Each workshop is attended by 70 to 120 teachers; in recent years, several educators have come from out-of-state. For returning educators, it is an opportunity to continue seeing how the MGS and MPF missions are unfolding by connecting directly with scientists and engineers who are involved with the projects. For educators who have never attended one of these workshops, it is an opportunity to network with other teachers who are using Mars as a vehicle to make science seem a little bit more exciting in the classroom. Educators that attend these workshops run the range from Kindergarten through community college grade levels.

The first of the biannual workshops held at ASU in 1996 was focused on educators who came to share activities that they had developed and tested in their classrooms. The second, held in August 1996, included all the latest information on the impending Mars launches, plus featured the ALH84001 "life on Mars" story. Dr. A. Treiman came out from the Lunar and Planetary Institute to share the ALH84001 findings and provided a unique, teacher-friendly perspective on the research results of *McKay et al.* [9]. In addition to the regular workshop series in 1996, we conducted a special workshop at the Hughes Santa Barbara Remote Sensing (SBRS) company in January 1996; a workshop in partnership with the Challenger Center in February 1996;

after-school teacher workshops in Twin Falls, Idaho (May, 1996) and Spokane, Washington (November, 1996); a teacher workshop at the Washington Science Teachers Association conference in Port Angeles (November, 1996); and we presided over 1 and 1/2 days of Mars workshops at the Phoenix, Arizona, Regional NSTA meeting in October 1996. The workshop with SBRS was conducted in Goleta, California, and brought together teachers from Arizona and southern California. The SBRS workshop included a tour of their spacecraft instrument facilities. The highlight of the SBRS workshop was an opportunity to see the MGS TES flight instrument, which at the time was being calibrated.

RED PLANET CONNECTION: One of the main focuses of the Arizona Mars K–12 Education Program is to seek ways to involve educators and students who are not normally reached by the means currently popular among K–12 outreach efforts. In other words, we sought to develop a National Standards-based method to share the Mars missions with *(a)* students who do not have access to the Internet, and *(b)* teachers who consider themselves to be "science-shy". The result is *Red Planet Connection: The Science Resource for Future Martians* (RPC). RPC is a quarterly publication produced during the school year that is focused on stimulating children's interest in science by using the topic of Mars exploration. RPC offers a unique opportunity for students to be directly connected with the long-term Mars Surveyor exploration effort.

Published in September, November, January, and March, there are three student editions (*Mariner*, grades K–2; *Viking*, grades 3–5; *Surveyor*, grades 6–8) and one teacher edition of RPC. The grades associated with each level are an approximation of the appropriate levels of readability, content, and activities; it is up to individual teachers to select the appropriate level for their students— indeed, some teachers are using it at the high school level, particularly in ESL (English as a Second Language) and remedial class settings. RPC is produced with the intent of being "teacher-friendly," to attract educators who do not have a strong science background. The teacher edition contains background information related to the theme of each issue of RPC, and the main hands-on science activity is always designed in consideration to minimize preparation time and materials required.

As of January 1997, RPC had 150 subscriptions. A subscription consists of 1 teacher edition plus 30 student editions (of the grade-level chosen by the educator). Some teachers laminate their copies and share with several classes. Assuming only 1 student to each copy of RPC, these issues are reaching a minimum of 4,500 kids as of January 1997. RPC has been endorsed by the Arizona Science Teachers Association (ASTA). RPC as a tool for enhancing student interest in science is the topic of a Masters degree thesis study due from co-author P. A. Dieck in May 1997.

MARS PATHFINDER CHANNELED SCABLAND FIELD TRIPS: In 1995, the Arizona Mars K–12 Education Program conducted the education and public outreach aspects of the *Mars Pathfinder* Field Trips and Workshop in the Channeled Scabland of Washington and Idaho. Thirteen Washington and Idaho educators were selected on a competitive basis to accompany Mars scientists and MPF engineers to the Scabland for field trips and a science workshop to discuss the nature of the Ares Vallis landing site. These educators went on to share their experiences with their students, schools, school districts, and communities. Their initial efforts and the outreach that took place during the week of the Scabland trips were detailed in Part 2 of *LPI Tech. Rept. 95-01* [4] and brief articles in *Eos, Trans. Am. Geophys. Union* [5, 6]. Since these were published, most of the thirteen educators have continued their outreach efforts, and much of this work has had a national-level impact (*e.g.,* efforts initiated by teacher F. O'Rourke of Cedar Wood Elementary in Everett, WA, led to a display in the Smithsonian Air and Space Museum [10]).

EVIDENCE OF IMPACT: Without a formal study, it is difficult to assess the full impact of the Arizona Mars K–12 Education Program. Anecdotal evidence (letters from teachers and students) are on file at our laboratory. One measure of success is the endorsement of RPC by ASTA, another is an award from ASTA to co-authors K.S.E. and P.R.C. for their efforts in working with science teachers. Still another measure was the appearance of K.S.E. on six Saturday morning children's television shows in the Phoenix, Arizona, area, to explain concepts of Mars science.

The Arizona Mars K–12 Program looks forward to continuing the effort to share and use the exploration of Mars as a tool to make science and education a bit more exciting and interesting for K–12 kids, teachers, and their families.

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